U. S. Army Air Forces Board

628

~~RESTRICTED~~

UNCLASSIFIED

REPORT

OF

THE ARMY AIR FORCES CENTER

ORLANDO, FLORIDA

TESTS CONDUCTED BY

AAF TACTICAL CENTER

ORLANDO, FLORIDA

and **U. S. DEPARTMENT OF AGRICULTURE**

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

with the co-operation of

AAF AIR TECHNICAL SERVICE COMMAND

ASF MOBILE CWS UNIT, BUSHNELL, FLORIDA

SUBJECT

DEVELOPMENT AND TEST OF SPRAY EQUIPMENT FOR L-5 AIRCRAFT FOR DISSEMINATION OF INSECTICIDE DDT

AAF BOARD PROJECT NO. 4469B452.26

DATE

5 June 1945

COPY NO. 259

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U.S. Army Air Forces Board

11-8-46

DEVELOPMENT AND TEST OF SPRAY EQUIPMENT FOR L-5 AIRCRAFT FOR DISSEMINATION OF INSECTICIDE DDT

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THE ARMY AIR FORCES BOARD
Orlando, Florida

5 June 1945

ARMY AIR FORCES BOARD PROJECT NO. 4469B452.26

DEVELOPMENT AND TEST OF SPRAY

EQUIPMENT FOR L-5 AIRCRAFT FOR DISSEMINATION OF INSECTICIDE DDT

1. Inclosed herewith is report of AAF Tactical Center, dated 11 May 1945, subject as above.

2. This project was authorized by 1st Indorsement to letter from AAF Board, dated 3 April 1945, subject: "Development and Test of Spray Equipment for L-5 Aircraft for Dissemination of Insecticide DDT", to Commanding General, Army Air Forces.

3. The AAF Board concurs in the conclusions and recommendations as stated in the inclosed report.

4. In accordance with paragraph 1 of indorsement referred to in paragraph 2 above, it is stated that developmental work is in progress to produce a demountable spray unit with a gross weight of not over 200 pounds. This development is further described in inclosure 3.

FOR THE ARMY AIR FORCES BOARD:

A.C. STRICKLAND
Brigadier General, U.S. Army
President

OFFICIAL:

Robert C. Walker Jr.

ROBERT C. WALKER, Jr.
1st Lt., Air Corps,
Recorder

Inclosure 1

Directive for Project

with 1st Indorsement from Headquarters
Army Air Forces

dated 19 April 1945

THE ARMY AIR FORCES BOARD
OFFICE OF THE PRESIDENT
Orlando, Florida

JRVD/TNB/dh-F

FILE:

3 April 1945

Please address reply to:
The PRESIDENT
ARMY AIR FORCES BOARD
ORLANDO, FLORIDA
ATTN: Armament Division

SUBJECT: Development and Test of Spray Equipment for L-5 Aircraft for Dissemination of Insecticide DDT.

TO: Commanding General, Army Air Forces, Washington 25, D.C. (Attn: AAF Board Control Office).

1. Reference letter, War Department, Office of Chief of Engineer, subject, "Airplane Sprayers", dated 24 January 1945, and subsequent indorsements thereto.

2. In view of the fact that AAF Board Project No. F4095, "Test to Determine Suitability of Specially Designed Spray Equipment for Dissemination of DDT from B-25 and C-47 Aircraft", has been completed in the field, and final report is being prepared, a new project was activated for testing of subject equipment. Through an error in the forwarding of the test program, the statement of military requirement for Airborne Spray System (Light), which requested that the spray system be designed for installation on wing racks on L-5 aircraft, was omitted. Subsequently, the AAF Tactical Center developed a tank for installation behind the pilot's seat in the aircraft. Although the equipment is highly satisfactory, it does not meet the specifications outlined in the Statement of Military Requirement. Since this equipment has already been completed, the AAF Board feels that a report should be prepared and circulated to the various theatres, so that the equipment can be utilized, pending development of the spray tank for suspension on wing racks, which will probably take several months. A new project could then be activated for this work.

3. In connection with the development of the spray system for wing rack suspension, the Air Technical Service Command advised that their priority on this project is 2B, while the AAF Board Project has a First Priority. It is therefore requested that the Air Technical Service Command priority be raised to 1A, so that the Air Technical Service Command and the AAF Board can carry out their development work simultaneously. This priority is deemed advisable because of the urgent need in the theatres for such equipment.

FOR THE PRESIDENT:

/s/ Gustav A. Neuberg
GUSTAV A. NEUBERG
Lt. Col., AGD
Recorder

Incl. #1

Basic: Ltr fr AAF Board dtd 3 Apr 1945, subject, "Development and Test of Spray Equipment for L-5 Aircraft for Dissemination of Insecticide DDT."

1st Ind. AFRET

Headquarters Army Air Forces, Washington 25, D.C. 19 Apr 1945

To: The President, Army Air Forces Board, Orlando, Florida

1. It is desired that action be initiated to prepare report for circulation to various theaters as recommended in basic communication. As availability of equipment that will permit airplanes to be employed for other uses will affect future requirements, subject report should clearly indicate that developmental work is in progress to produce a light Airborne Insect Spray System that can be readily attached to any standard AAF Liaison airplane equipped with suitable shackles.

2. Assignment of 2B priority to this project is considered the highest that can be justified in accordance with provisions of AAF Regulation 65-3 dated 15 March 1945.

3. When Air Technical Service Command produces a spray system to fulfill the requirements indicated for a suitable Airborne Insect Spray System (Light) it is desired that tactical suitability tests be conducted under Restricted classification and 2B priority.

BY COMMAND OF GENERAL ARNOLD:

/s/ H. S. Ecklund, Col., AC
For DONALD WILSON
Major General, U. S. Army,
Asst. Chief of Air Staff,
Operations, Commitments &
Requirements

Inclosure 2

Army Air Forces Tactical Center Final Report

Dated 11 May 1945 with Inclosures

HEADQUARTERS
ARMY AIR FORCES TACTICAL CENTER
ORLANDO, FLORIDA

11 May 1945

ARMY AIR FORCES BOARD PROJECT NO. 4469B452.26

Development and Test of Spray Equipment for the L-5 Airplane for Dissemination of the Insecticide DDT.

I. OBJECT:

The object of this project is to provide a suitable spray unit for the L-5 (liaison type) airplane, which would utilize the full pay-load of this type aircraft; and to provide the most efficient and effective method for dissemination of DDT sprays for insect control.

II. FACTUAL DATA:

a. Cooperating Agencies. The results of this project represent the combined efforts of personnel of the following commands and agencies: Army Air Forces Tactical Center; Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture; Army Air Forces Air Technical Service Command; and the Army Service Forces Mobile CWS Unit, Bushnell, Florida. The plane spray equipment tested was designed and developed by the Orlando Laboratory, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. It was constructed by the Base Maintenance Shop, Orlando Army Air Base.

b. Equipment for Dispersing Spray Materials.

(1) An L-5 (liaison type) airplane was chosen because of its availability in all theatres of operations. In the use of the breaker bar equipment, a thirty-six gallon tank was fitted into the seat behind the pilot and a one-half inch herringbone pump, mounted on the left wing strut and operated by a wind-driven, four-bladed propeller. This developed one hundred and twenty pounds per square inch pressure for the propulsion of the solution (Cf. Figs. 1, 2, and 5; Inclosure VII). Approval was obtained from AAF Air Technical Service Command authorizing the transport of a total of three hundred and fifty pounds of material, thus giving 32.4 percent mean aerodynamic cord (MAC) (Cf. Incl. II). A forty-two gallon tank was designed, which more nearly fulfilled the requirements of a maximum pay-load, retaining the features of accessibility and ease of removal. All biological and physical data contained in this report have been based on flights employing the earlier thirty-six gallon tank. The flow rates from the forty-two gallon tank have been shown to be consistant with observations using the thirty-six gallon tank (Cf. Incl. III).

(2) Two types of spray dispensers were used, namely:

(a) Modified L-4 Equipment. A Sprayer, Insect, Airplane, Complete (Spec. No. T-2281, Corps of Engineers), the Husman-Longcoy Apparatus, was modified for installation on the L-5 airplane by removing the venturi (Cf. Figs. 3 and 4, Incl. VII).

(b) Breaker Bar Equipment. This consists of a breaker bar boom mounted under each wing (Cf. Figs. 1, 2, 6 & 7, Incl. VII). A breaker bar dispenser consists of the two sections: a tubing one-half inch in diameter and four feet in length, with forty holes of seventy-one wire gauge spaced equi-distant along its length; and a milled bar slightly beveled placed one-quarter inch from the spray opening. This is held in place by three mounting studs. A breaker bar boom is clamped to the wing struts of each wing. The spray liquid is delivered from the tank to each breaker bar by oil resistant hose through the gear pump. This develops one hundred twenty pounds pressure. Ten gallons of spray is dispersed per minute. A cut-off valve between the pump and breaker bar permits the operator to turn the spray on and off at will. When not spraying, the back pressure on the pump acts as a brake.

c. DDT Formulae. 5% DDT (w/v) in 20% No. 30 SAE lubricating oil and 80% No. 2 Diesel fuel oil (v/v) was used in all tests; 0.7% (w/w) Dupont oil red dye was added to permit colorimetric determinations.

d. Test Procedures.

(1) Ground Phase.

(a) Test plot - The test plot was located on level open grassland. Ten stations forty feet apart were laid out, placed at a ninety degree angle to the line of flight. Exceptions to this are noted in Inclosures IV and V. Plane courses were run up-, down-, and cross-wind.

(b) Stations - Test data were obtained at each station by exposing containers of Anopheles quadrimaculatus larvae, petri dishes for flies, CWS plates for a quantitative determination of DDT deposit, and magnesium oxide coated slides for particle size and mass deposit determinations (Cf. Figs. 8 and 9, Incl. VII).

(c) Sampling methods - The following sampling methods were used for making swath-width and other determinations.

1. Anopheles Larvae Kill. A pint cardboard carton was exposed at each station with twenty early fourth instar Anopheles quadrimaculatus larvae. Percentage kill was recorded twenty-four hours after exposure to the spray.

2. CWS Plates. Twelve-inch CWS porcelain plates were exposed to the spray and the DDT deposit calculated by a colorimetric determination of the dye.

3. Magnesium Oxide Slides. Microscope slides were coated with magnesium oxide and the diameters of the deposited particles measured microscopically. Particle spectra (particle size range) were computed and mass deposit determined.

4. Housefly Kill. Clean petri dishes were exposed to the spray. The time required to obtain 50 percent and 100 percent knockdown respectively of laboratory reared Musca domestica was determined. This was done by placing wire screen cages containing houseflies over the exposed surfaces of the petri dishes.

(2) Air Phase.

(a) Plane speed: ninety miles per hour.

(b) Altitudes: forty and one hundred feet.

(c) Line of flight: up-, down-, and cross-wind.

e. Auxiliary Aids. Meteorologic and photographic (Cf. Incl. VII).

f. Results Obtained. Flow rate data for the modified L-4 equipment and the L-5 breaker bar equipment are noted (Cf. Incl. III). Maximum operational efficiency was obtained with the L-5 dispenser, which gave an eighty foot swath-width at a dosage of 0.3 pounds DDT per acre. Data relative to the mortality of anopheline larvae, knock down of adult flies, deposition of DDT and median diameters of particles by weight and number for the modified L-4 and the L-5 breaker bar equipment are presented. (Cf. Incl. IV and V). Particle size and distribution for the L-5 breaker bar equipment are given in Inclosure VI. A highly satisfactory kill of mosquito larvae and knockdown of fly

adults was achieved under the conditions of these tests. The various biological, chemical, and physical means for determining the spray pattern showed a close inter-relationship. A more uniform spray pattern was produced with the L-5 breaker bar equipment.

III. CONCLUSIONS:

The following conclusions are made:

a. The breaker bar spray unit, designed for the L-5 (liaison type) airplane, as described, is a highly satisfactory unit for spraying solutions of DDT for purposes of insect control.

b. The operation of this equipment is more efficient than the Sprayer, Insect, Airplane (Spec. No. T-2281), now under limited procurement by the Corps of Engineers.

c. An efficient and effective control of insects in open and semi-open terrains can be obtained through the use of this equipment when used as recommended.

d. The L-5 unit should have a capacity of forty-two gallons of DDT solution.

e. Using a 5 percent solution of DDT in No. 2 fuel oil and employing 0.3 pounds per acre under optimum conditions an area of sixty-one acres can be covered during one flight. Half this area can be covered employing 0.6 pounds per acre.

f. Using a five percent solution of DDT, when the plane was flown with a distance of 160 ft. between lines of flight, a dosage of 0.15 pounds per acre resulted; at a distance of 80 feet, 0.3 pounds per acre resulted; and at a flight distance of 40 feet, 0.6 pounds per acre resulted.

g. The optimum conditions of flight to meet varying field requirements including semi-open terrain and various insect conditions are as follows:

(1) Altitude of release: 40 to 100 feet above the ground or above the tree tops.

(2) I. A. S.: 90 to 100 miles per hour.

(3) Wind velocity: 3 to 10 miles per hour.

(4) Line of flight: at a right angle to the direction of the wind or within 22.5 degrees thereof (Cf. AAF Bd Report F-4095).

(5) Distance between lines of flight: 80 feet (0.3 pounds per acre); 40 feet (0.6 pounds per acre).

(6) Time of day: during conditions of inversion or low turbulence, e.g., early morning prior to one hour after sunrise.

h. Spray recoveries of over 95 percent were obtained under a seven mile per hour wind over a distance of 525 feet from the line of flight as determined by both the CWS colorimeter method and the use of the magnesium oxide slide method.

i. The median particle size in these tests was 160 micra by weight and 80 micra by number. A more even deposit of spray to 200 micra was obtained in this project than had been observed in previous studies using heavier aircraft. (Cf. AAF Bd Project F-4095 and Inclosure VI).

IV. RECOMMENDATIONS:

It is recommended:

a. That the L-5 breaker bar spray unit, as tested and described, be accepted for limited procurement and use by the Army Air Forces for the spraying of DDT for purposes of insect control.

b. That a dosage of approximately 0.3 to 0.6 pounds of DDT per acre be used to insure adequate coverage.

c. That for best results, DDT spray operations be carried out insofar as possible under optimum flight conditions. (Cf. Par. III g.).

V. DISCUSSION.

a. Developmental Background. The first airplane spray equipment for DDT was developed in 1943 by engineers of the Orlando Laboratory of the U. S. Department of agriculture. A twenty-five gallon tank placed behind the pilot was connected through a wind-driven herringbone pump to a boom of four impactor jets located along the edge of a venturi fastened beneath the belly of the plane. The purpose of the venturi was to increase the air pressure against the impactor plates of the jets. The apparatus designed for the L-4 airplane, called the F-1 spray apparatus (C.E. Spec. 2281), was sent out to various theatres for trials. Some use has been made of the L-4 equipment as such or as locally modified for use on the more generally available L-5 airplane. The use of this equipment on the L-5 was not considered safe because of the adverse effect of the venturi on the flying characteristics of higher speed airplanes. Because of the greater speed of the L-5 of about 90 to 100 miles per hour, it was thought that the jet boom could be used without the venturi and that the output of DDT solution could be held to the required amount by

increasing the number of jets from six to eight. The previously used six jet boom on the L-4 gave off four gallons per minute (forty-five pounds pressure). An L-4 at sixty miles per hour making a forty foot swath would deposit 0.36 pounds of DDT per acre. This constituted a satisfactory method of applying light coverage DDT with the L-4 plane. The eight jet boom on the L-5 (modified L-4 equipment) producing a forty foot swath at ninety miles per hour, put out four gallons per minute with 45 pounds pump pressure or 0.25 pounds per acre. With an increase in pump pressure to 160 pounds, six gallons per minute were produced giving 0.36 pounds per acre. This was equally as satisfactory a result insofar as output was concerned as that obtained with the six jet boom (L-4). The greater speed, carrying capacity and maneuverability of the L-5 made this plane more desirable. An even greater output could be obtained by increasing the number of jets and the pump pressure.

b. Advantages of Breaker Bar Equipment. These are summarized as follows:

(1) A more uniform spray pattern is produced.

(2) The interval between flights (swath width) is increased to eighty feet at a dosage of 0.3 pounds per acre, and to forty feet at a dosage of 0.6 pounds per acre.

(3) The equipment does not spray the fuselage with deleterious chemicals.

(4) The apparatus is removed from under the plane, which is an advantage in rough landing fields.

(5) The spray and spray plume are visible to the pilot at all times.

(6) It is easier to make the equipment corrosion-proof.

(7) Precautions should be taken, however, that the pump is not run dry.

c. Dosage. The dosage range with this apparatus varies with three factors: the concentration of the solution, the altitude of the plane, and the pressure applied to the spray. The pressure should be determined individually. In order to obtain an economical aerial distribution of DDT, it is desirable that the output of the spray unit be constant. The L-5 spray unit is one of the few types of equipment which approaches this requirement. The unit, because of closer contact with the ground, enables a more economic application of DDT and thus is considered particularly useful for local control.

In the determinations used as a basis for this report only a 5 percent solution of DDT in fuel oil, kerosene, etc., has been considered. A range of 0.3 to 0.6 pounds DDT per acre, maintaining the conditions indicated, has been recommended. The lower concentrations hold in open and semi-open areas. Increasing concentrations are required as vegetation increases and canopy becomes increasingly dense.

d. Use of the L-5 Equipment. The L-5 spray equipped airplane is most effectively used as an adjunct to regular malaria control methods. One to three planes assigned to each base can effectively control most insect disease vectors in and about cantonment areas. This is essential in those combat areas where control must be effected with a minimum of delay. In theatres where time does not permit long term drainage projects, the L-5 is considered effective for the control of swamp areas. The L-5 can provide adequate control for hilly scanty jungle terrains in which heavier type planes cannot maneuver. The equipment may also be used to advantage for the spraying of open water areas,winding streams, and narrow valley areas.

Caution: In spraying operations it should be emphasized that the pump must never be run dry. When not in use, the pump propeller should be tied fast. In event of damage to the light weight herring-bone pump provided depot and machine shop facilities are available, the Vickers half-inch pump (PF 2-713-25-BCE) used on B-29 aircraft may be used as a substitute. This is a positive pump and develops a greater pressure and flow. For these reasons it requires a valve control by pass to offset the increase in pressure or a pressure relief valve.

VI. INCLOSURES:

a. Inclosure I - Letter, subject: Development and Test of Spray Equipment for L-5 Aircraft for Dissemination of Insecticide DDT, 3 March 1945.

b. Inclosure II - TWX from AAF Air Technical Service Command, approving 350 pounds in observer seat, giving a 32.4 percent MAC.

c. Inclosure III - Materiel list, flow rate charts, and drawings of spray equipment.

d. Inclosure IV - Data on modified L-4 equipment.

e. Inclosure V - Data on L-5 breaker bar equipment.

f. Inclosure VI - Data on particle size and distribution.

g. Inclosure VII - Photographic record of tests.

PREPARED BY:

/s/ William N. Sullivan, Jr.
WILLIAM N. SULLIVAN, JR.
Captain, Sanitary Corps,
AFTAC, Project Officer.

CONCURRED IN BY:

/s/ John Q. A. Daniels
JOHN Q. A. DANIELS,
Lt. Colonel, Medical Corps

/s/ O. B. Schreuder
O. B. SCHREUDER
Colonel, Medical Corps,
Surgeon, AFTAC

ARMY AIR FORCES BOARD
Office of the President
Orlando, Florida

3 March 1945.

SUBJECT: Development and Test of Spray Equipment for L-5 Aircraft for Dissemination of Insecticide DDT.

TO : Commanding General, AAF Tactical Center, Orlando, Fla.
Attn: Director of Operations.

1. The Army Air Forces Board requests that the AAF Tactical Center jointly with the U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, Orlando, Florida, and the Air Technical Service Command, Wright Field, Dayton, Ohio, develop and test a suitable spray unit for L-5 aircraft for efficient dissemination of insecticide DDT.

2. The object of this development and test program will be to provide a suitable spray unit for the L-5 aircraft which will utilize the full pay-load of this type airplane, and provide the most efficient and effective dissemination of DDT spray for insect control.

3. This is a first priority test and will be classified as Restricted.

4. The AAF Board assigns this test Project No. F-4469, and title "Development and Test of Spray Equipment for L-5 Aircraft for Dissemination of Insecticide DDT". Captain T. N. Belton is designated as AAF Board Project Officer for this test.

5. It is requested that Captain W. N. Sullivan, Sn. C., be designated as AFTAC Project Officer.

6. The AAF Board further requests that the AAF Board Project Officer be consulted in the preparation of the test program and that such test program be prepared and submitted to the AAF Board for approval at the earliest possible time. Close liaison in the development and test program will be maintained between the AAF Board Project Officer, AFTAC Project Officer; the Office of the Air Surgeon, Headquarters Army Air Forces, Washington, D. C., Chief of the Air Surgeon Branch, AFTAC: U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, Orlando, Florida, and the Air Technical Service Command, Wright Field, Dayton, Ohio.

7. The AAF Board also requests that three copies of the Final Report, bearing the AAF Board Project Number, be forwarded upon completion of the test.

Incl. 1.

Ltr dtd 3 March
Subject: Development and Test of Spray Equipment for L-5 Aircraft for Dissemination of Insecticide DDT.

FOR THE PRESIDENT:

/s/ William W. Momyer
WILLIAM W. MOMYER
Colonel, Air Corps
Executive

Inclosure 1, Page 2.

WR-25 10 APRIL 1945

P
FROM KNUDSEN ATSC 102247Z
TO CO ORLANDO AAB ATTN....SUPERVISOR OF MAINT
TSEPL3H6-4-75 L-5 AIRPLANE NO 43-98139 THIS COMMAND APPROVES 350 POUNDS IN OBSERVERS SEAT GIVING 32.4 PERCENT MAC. SIGNED ENGINEERING DIVN

AE

EE

ORL RECD WR-25 11526Z EDW

Incl. 2.

MATERIAL LIST

Tubing - Steel, Chrome Nickel Corrosion Resistant, Round Seamless

2"	2 7/8 OD x .250 S.W.
14'	11/16 OD x .035 S.W.
1'	13/16 OD x .035 S.W.
2 1/2'	1/4 OD x .035 S.W.
14 1/2'	3/8 OD x .035 S.W.

14 ft. 5/8 Copper tubing

Round Stock - Steel, Chrome Nickel Corrosion Resisting

1 ft. 1/4" Round
1 length 1/8 Welding Rod, Stainless
2 ft. 3/16 Round

Round Stock - 52 S Alum

3" long 1 1/2" OD Round

Pipe Fittings - Brass

1 ea.	Tee 5/8" Tubing
2 ea.	Elbows 1/2" Pipe to 5/8" Tube
1 ea.	1/2" Close Nipple
1 ea.	1/2 Street Elbow
1 ea.	Tee 1/2 x 1/2 x 1/4
1 ea.	3/8 Pipe Coupling
2 ea.	3/8 Pipe Plugs
1 ea.	1/2 Nipple 2" Long

Sheet Stock

1 piece 1/8" thick Alum Alloy 8" x 2 1/2"
1 piece 1/4" thick Alum Alloy 5 ft. x 2"
1 piece 3/32" thick Stainless Steel 4" x 4"
1 piece 1/16" thick Stainless Steel 6" x 6"
1 piece 1/8" thick Stainless Steel 6" x 12"
2 Sq. ft. .040 Stainless Steel Sheet

Incl. 3, Page 1.

48 sq. ft. .064 2-S 1/2 hard Alum. Sheet

Brake Lining

1 piece	1" Wide 8" Long 3/32 Thick
12	Rivets Brake Lining Brass

1/32" Thick Gasket Material 6" x 12"

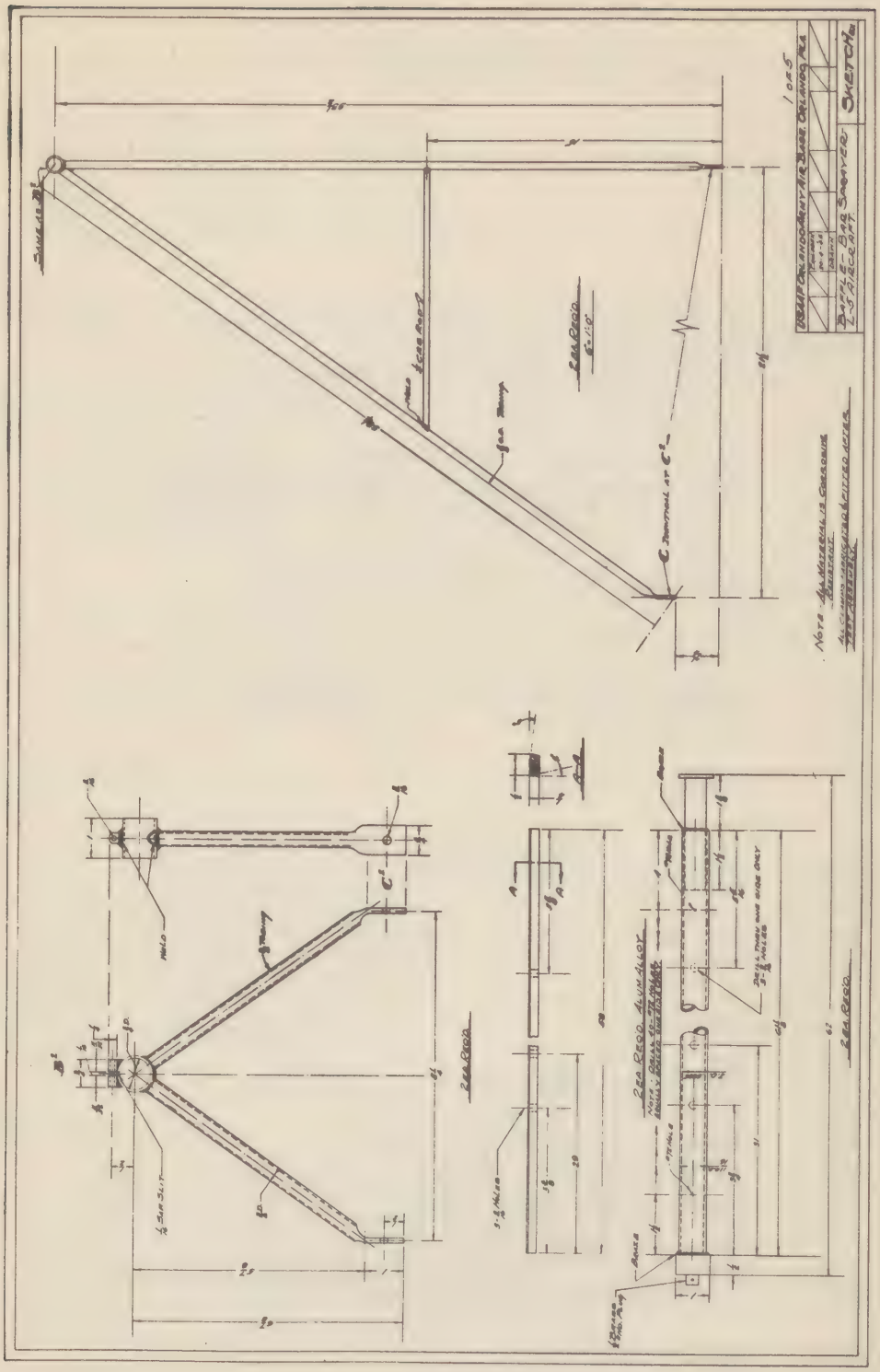
Miscellaneous

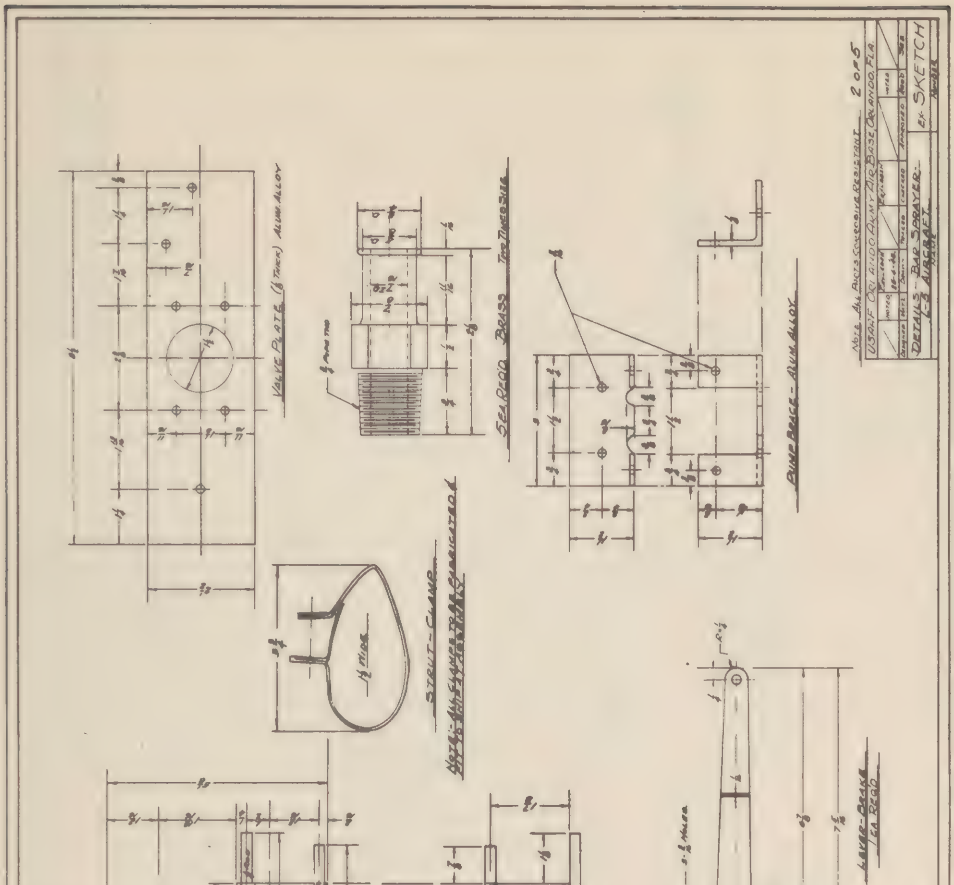
8 ft.	1" x 6" Spruce (Propeller)
1	Choke wire and cable 5 ft. long
4	#8 Flat Head Wood Screws Brass
1	Pressure Gauge 1 to 200 lbs.
1	1/2" Rotary gear pump - Herringbone Type
3	1 1/2 x 1 1/2 Augh Iron
1 1/2 ft.	7/8 Soft Brass Hex Hose Connection
1	Valve, Parker 1/2 pipe each end
6	Clamps, loop type 5/8 6500-289300
8	Clamps, Hose #8
2	Corks 1 1/2 diam.
1	Tank or Radiator Filler Cap & Neck
1 piece	#50 Brass Gauge 6" x 6"
6 ft.	5/8 Hose, Aromatic Fuel

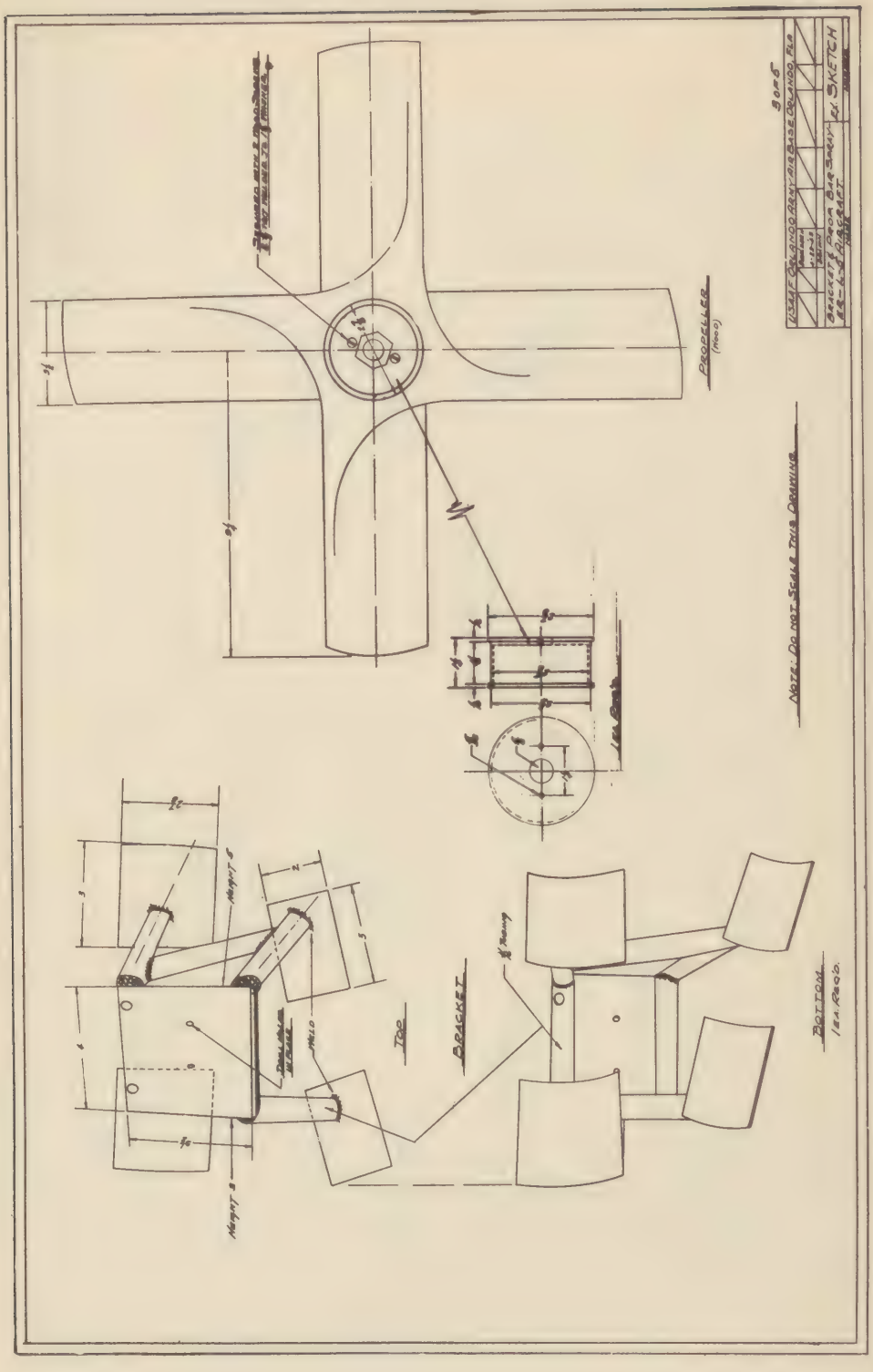
Screws, Bolts, and Nuts

24 ea.	#10 Sheet Metal Screws 1 1/2" long
8 ea.	10/32 x 1 3/8 long. Bolts
6 ea.	10/32 x 1 1/4 long. Bolts
4 ea.	10/32 x 1 long. Bolts
8 ea.	10/32 x 3/4 long. Bolts
2 ea.	1/4 - 28 1 1/2 long. Bolts
2 ea.	10/32 Screws Button head 1/2 long
2 ea.	10/24 Screws Button head 1/2 long
1 ea.	5/8 - 18 Hex nut
1 ea.	3/8 - 24 Bolt 1" long

Incl. 3, Page 2.




VALVE PLATE (1/8 THICK) ALUM ALLOY
STRUT-CLAMP
PUMP BRACE - ALUM ALLOY
STAND-BRAKE
1 EA REQD
LEVER-BRAKE
1 EA REQD
SHOE-BRAKE
1 EA REQD
FLOAT-TANK- 1 EA REQD
2 OF 5
DETAILS - BAR SPRAYER - L-3 AIRCRAFT
EX-SKETCH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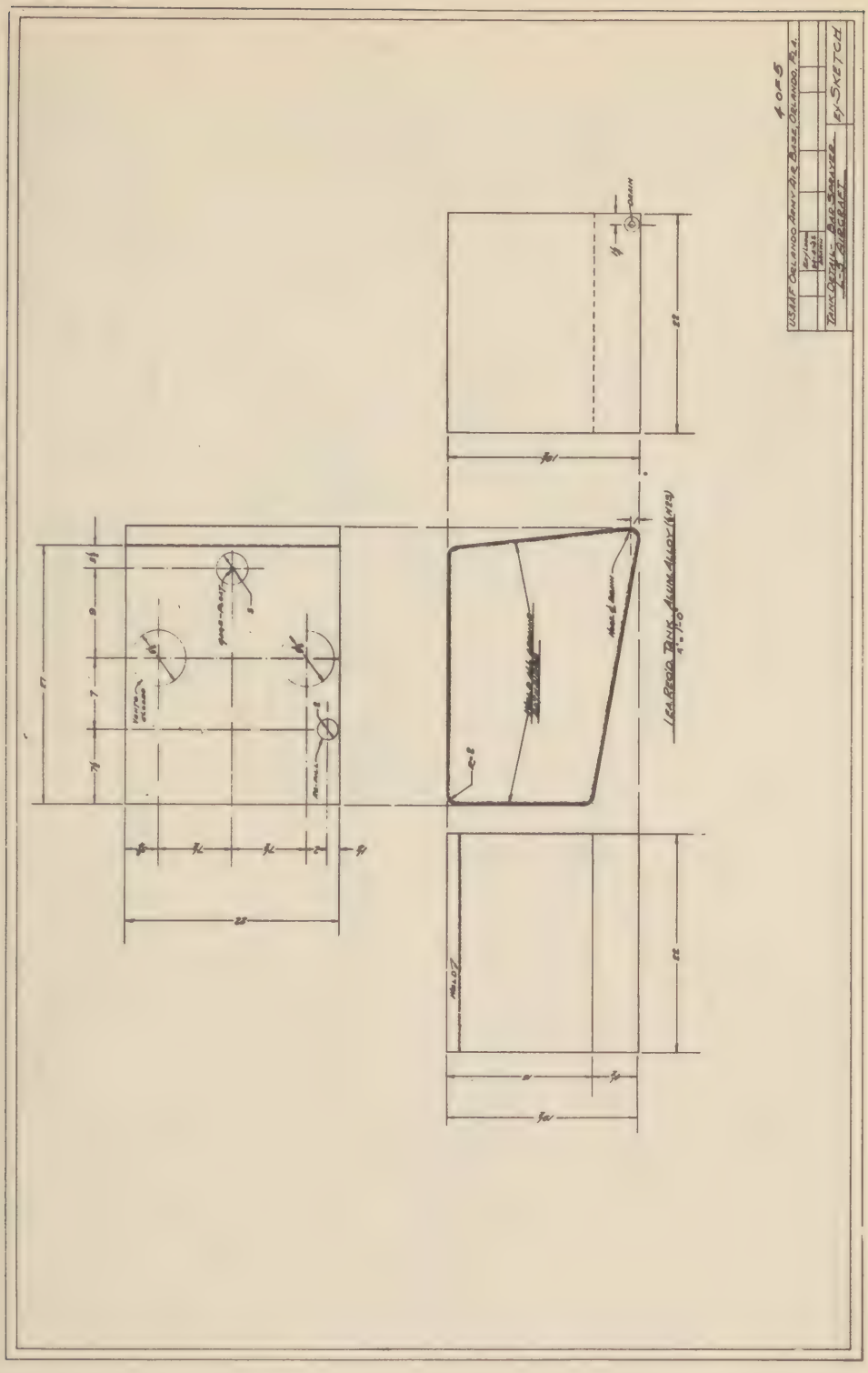
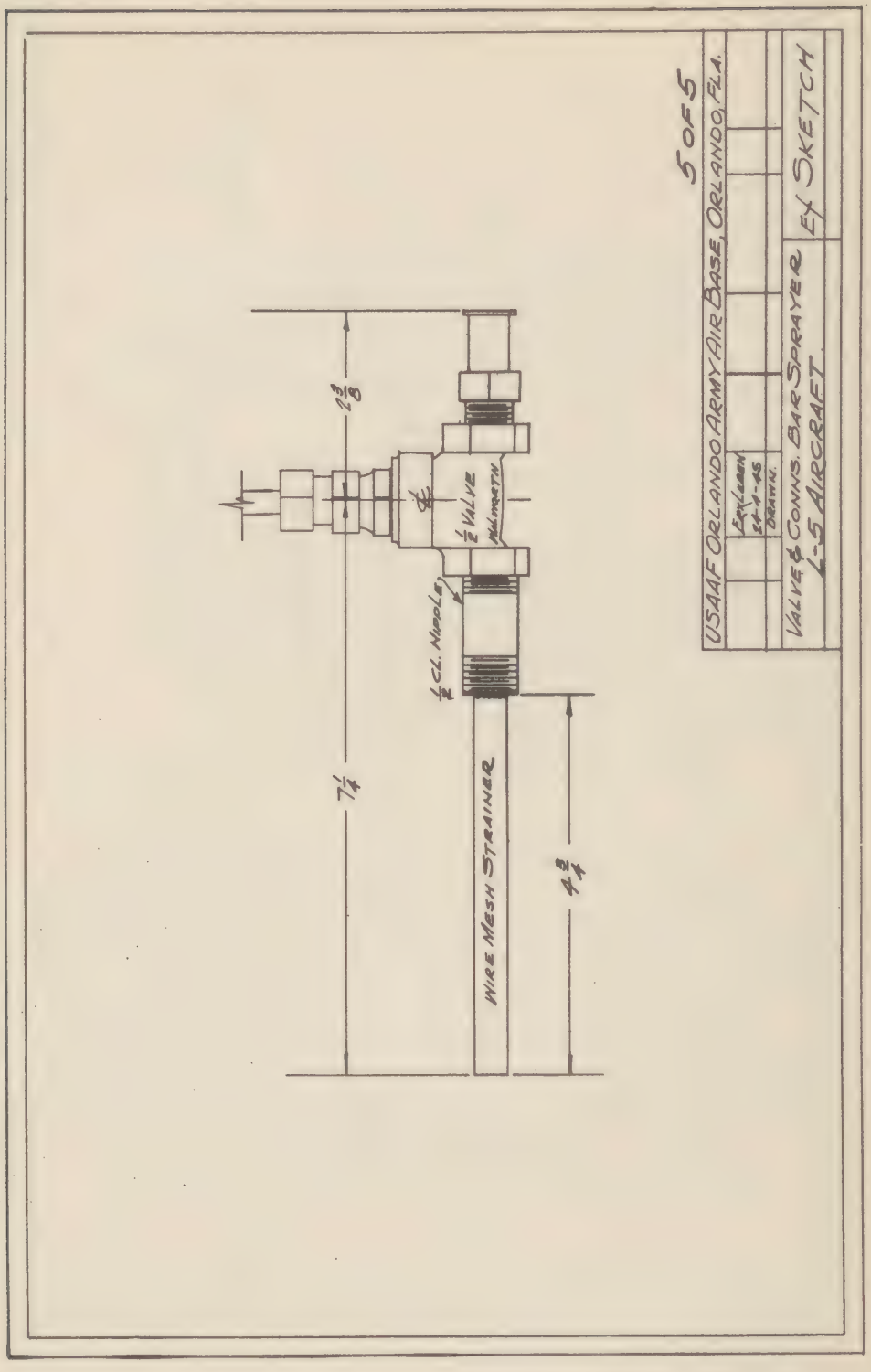
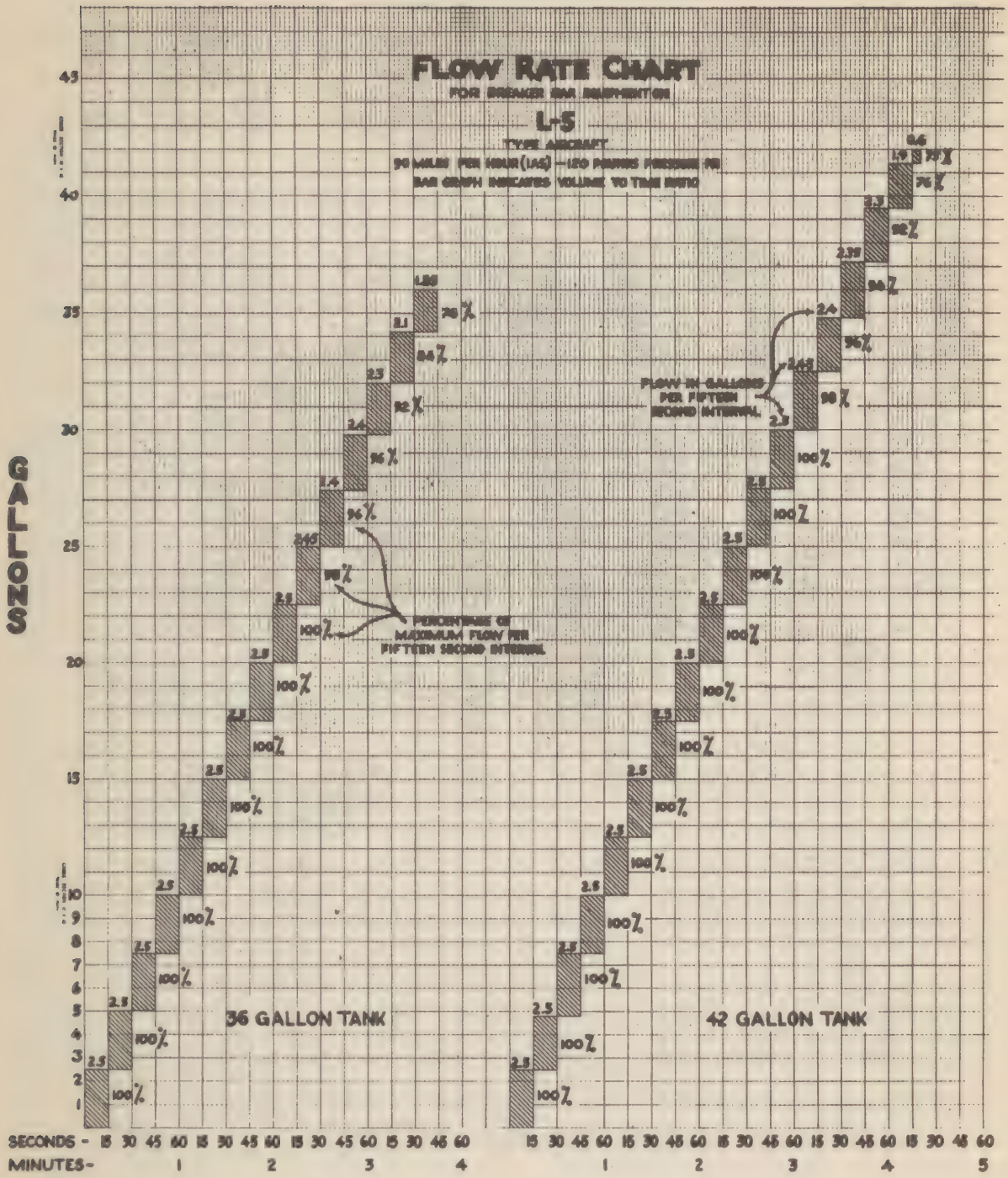



5 OF 5
USAAF ORLANDO ARMY AIR BASE, ORLANDO, FLA.
EX SKETCH
VALVE & CONNS. BAR SPRAYER
L-5 AIRCRAFT
1⅜
½ VALVE
½ CL. NIPPLE
WIRE MESH STRAINER
7¼
4⅜



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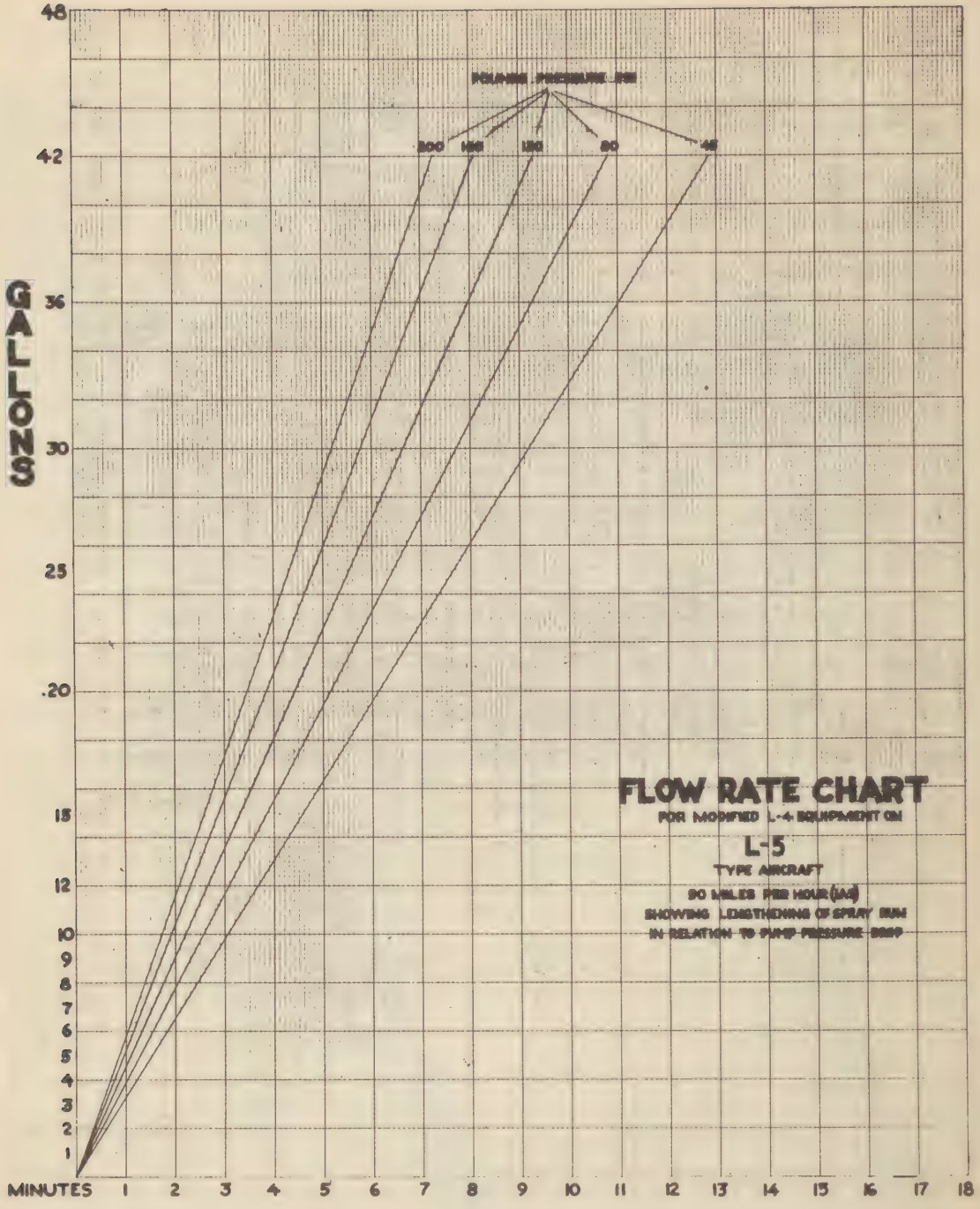

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TABLE I

DATA RELATIVE TO MORTALITY OF ANOPHELINE LARVAE, ADULT FLIES, DEPOSITION OF DDT AND MEDIAN DIAMETERS OF PARTICLES BY WEIGHT AND NUMBER

PLANE: L-5
EQUIPMENT: Modified L-4 Equip.
DELIVERY RATE: 4 Gal. per Minute
PRESSURE: 45 Lbs. PSI

DATE: 5 April 1945
PLANE SPEED: 90 MPH 20% Lube Oil
SPRAY SOLUTION: 5% DDT in 80% DFO #2
STATION POSITION: 40 Ft interval 4,5,6,7
20 ft interval 1-3,8-10

TEST NO. One
TIME: 0844
ALTITUDE: 100 ft.
LINE OF FLIGHT: Over Sta 7, NW to SE

LAPSE RATE: T2-T.3-.4
WIND SPEED: 5 MPH
WIND DIRECTION: S
WIND DRIFT: E

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		100	100	100	100	95	5	5	5	5	0
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%	10	9	-	7	10					
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	15	14	-	15	16	180+	180+	180+	180+	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	14.3	19.5	30.1	19.2	31.2	-	-	-	-	-
	+	4.6	4.4	7.5	7.9	2.8	0.0	0.0	0.0	0.0	0.0
MEDIAN DIAMETER IN MICRA BY NUMBER		140	170	140	160	200	-	-	-	-	-
MEDIAM DIAMETER IN MICRA BY WEIGHT		170	250	240	260	310	-	-	-	-	-

TEST NO. Two
TIME: 0905 - 0909
ALTITUDE: 40 Ft.
LINE OF FLIGHT: Over Sta. 8 N to S

LAPSE RATE: T-2T.3-1.1
WIND SPEED: 7 MPH
WIND DIRECTION: SW
WIND DRIFT: E

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		90	100	95	100	100	30	0	0	0	0
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%	17	12	10	9	8	36				
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	21	16	15	16	12	55	180+	180+	180+	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	11.5	25.6	24.3	26.7	24.7	3.7	-	-	-	-
	+	3.7	7.5	7.3	6.4	8.3	0.4	0.0	0.0	0.0	0.0
MEDIAN DIAMETER IN MICRA BY NUMBER		120	120	113	133	103	640				
MEDIAN DIAMETER IN MICRA BY WEIGHT		160	230	223	257	227	640				

* USDA
+ CWS

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TABLE II

DATA RELATIVE TO MORTALITY OF ANOPHELINE LARVAE, ADULT FLIES, DEPOSITION OF DDT AND MEDIAN DIAMETERS OF PARTICLES BY WEIGHT AND NUMBER

PLANE: L-5
EQUIPMENT: Modified L-4
DELIVERY RATE: 4 Gal. per Minute
PRESSURE: 45 Lbs. PSI

DATE: 5 April 1945
PLANE SPEED: 90 MPH
SPRAY SOLUTION: 5% DDT, in 80% DFO #2. 20% Lube Oil
STATION POSITION: 40 Ft. Interval

TEST NO. Three
TIME: 0927
ALTITUDE: 40 Ft.
LINE OF FLIGHT: Sta. 10-NW to SE

LAPSE RATE: T2-T.3-1.3
WIND SPEED: 5 MPH
WIND DIRECTION: SSW
WIND DRIFT: NE

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		0	100	80	100	10	45	100	25	40	5
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%		56	44	23		58	61			
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	180+	80	53	30	180+	72	80	180+	180+	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	-	-	2.9	7.6	0.6	1.3	0.9	0.9	0.1	0.04
	†	1.0	0.2	0.5	0.7	0.4	0.0	3.8	0.9	0.0	0.0
MEDIAN DIAMETER IN MICRA BY NUMBER		-	-	-	220	70	100	100	80	-	-
MEDIAN DIAMETER IN MICRA BY WEIGHT		-	-	-	250	100	110	100	100	-	-

TEST NO. Four
TIME: 0957
ALTITUDE: 40 Ft.
LINE OF FLIGHT: Beyond Sta. 10 NW to SE

LAPSE RATE: T2-T.3-1.6
WIND SPEED: 5 MPH
WIND DIRECTION: SW
WIND DRIFT: NE

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		100	95	85	-	0	0	5	5	5	0
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%	36	54								
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	46	62	180+	180+	180+	180+	180+	180+	180+	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	9.1	2.8	0.2	0.7	0.1	0-04	-	0.03	-	-
	-	2.4	1.7	0.2	0.3	0.3	0.0	0.1	0.0	0.0	0.0
MEDIAN DIAMETER IN MICRA BY NUMBER		150	120	50	83	90	-	-	-	-	-
MEDIAN DIAMETER IN MICRA BY WEIGHT		250	170	80	123	120	-	-	-	-	-

* USDA
† CWS

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TABLE III

DATA RELATIVE TO MORTALITY OF ANOPHELINE LARVAE, ADULT FLIES, DEPOSITION OF DDT AND MEDIAN DIAMETERS OF PARTICLES BY WEIGHT AND NUMBER

PLANE: L-5
EQUIPMENT: Modified L-4 Equip.
DELIVERY RATE: 4 Gal. per Minute
PRESSURE: 45 Lbs. PSI

DATE: 6 April 1945
PLANE SPEED: 90 MPH 20% Lube Oil
SPRAY SOLUTION: 5% DDT in 80% No. 2 DFO
STATION POSITION: 40 Ft. Int. Sta. 4,5,6,7
20 Ft. All Others

TEST NO. Five
TIME: 0750
ALTITUDE: 40 Ft.
LINE OF FLIGHT: Sta. 5 S to N

LAPSE RATE: T2-T.3+.1
WIND SPEED: 6 MPH
WIND DIRECTION: NNE
WIND DRIFT: W

STATION		1	2	3	4	5	6	7	8	9	10
% MORTLAITY OF ANOPHELINE LARVAE		5	10	0	10	0	100	100	100	100	100
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%						15	16	16	26	18
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	180+	180+	180+	180+	180+	25	23	21	29	22
MGM OF DDT RECOVERED PER SQUARE METER	*	0.0	0.0	0.0	0.0	0.0	18.0	6.8	2.7	3.0	5.6
	+	1.7	2.3	0.8	0.9	1.2	4.5	5.0	4.8	3.5	4.3
MEDIAN DIAMETER IN MICRA BY NUMBER		-	-	-	-	-	263	-	150	80	100
MEDIAN DIAMETER IN MICRA BY WEIGHT		-	-	-	-	-	277	-	180	190	130

TEST NO. Six
TIME: 0807
ALTITUDE: 40 Ft.
LINE OF FLIGHT: Sta. 5 N to S

LAPSE RATE: T2-T.3 0
WIND SPEED: 7 MPH
WIND DIRECTION: NE
WIND DRIFT: To W.

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		5	5	5	5	15	100	100	100	100	75
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%						13	18	18	25	
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	180+	180+	180+	180+	180+	19	21	26	31	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	0.0	0.0	0.0	0.0	0.0	19.2	8.7	6.3	7.1	0.53
	+	0.0	0.3	0.4	0.7	0.4	7.1	3.8	4.2	3.8	1.9
MEDIAN DIAMETER IN MICRA BY NUMBER		-	-	-	-	-	133	150	150	190	-
MEDIAN DIAMETER IN MICRA BY WEIGHT		-	-	-	-	-	366	200	170	240	-

* USDA
+ CWS

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TABLE IV

DATA RELATIVE TO MORTALITY OF ANOPHELINE LARVAE, ADULT FLIES, DEPOSITION OF DDT AND MEDIAN DIAMETERS OF PARTICLES BY WEIGHT AND NUMBER

PLANE: L-5
EQUIPMENT: Modified L-4 Equipment
DELIVERY RATE: 4 Gal. per Minute
PRESSURE: 45 Lbs. PSI

DATE: 6 April 1945
PLANE SPEED: 90 MPH 20% Lube Oil
SPRAY SOLUTION: 5% DDT in 80% No. 2 DFO
STATION POSITION: 40 Ft. Interval

TEST NO. Seven
TIME: 0832
ALTITUDE: 40 Ft.
LINE OF FLIGHT: 60 Ft beyond Sta. 1 - SE to NW

LAPSE RATE: T2-T.3-.3
WIND SPEED: 7 MPH
WIND DIRECTION: NNE
WIND DRIFT: SW

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		10	70	25	-	5	80	85	95	80	60
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%		40	47			48	53	54		
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	180+	53	61	180+	180+	71	79	77	180+	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	0.2	0.2	9.0	1.7	0.03	0.9	1.1	4.0	2.1	0.2
	+	0.0	0.5	0.2	0.0	0.0	0.2	0.7	0.3	0.6	0.0
MEDIAN DIAMETER IN MICRA BY NUMBER				475				150		150	120
MEDIAN DIAMETER IN MICRA BY WEIGHT				480				170		170	150

TEST NO. Eight
TIME: 0852
ALTITUDE: 100 Ft.
LINE OF FLIGHT: 175 Ft beyond Sta. 1 - SE to NW

LAPSE RATE: T2-T.3-.3
WIND SPEED: 8 MPH
WIND DIRECTION: NE
WIND DRIFT: To SW

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		5	90	90	50	100	100	100	100	100	100
MINUTES TO KNOCKDOWN OF ADULT FLIES IN	Morib. 50%		22	22	24	25	36	24	23	31	33
PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 100%	180+	29	31	34	32	51	36	34	42	62
MGM OF DDT RECOVERED PER SQUARE METER	*	0.0	2.9	10.2	5.2	1.4	3.1	3.6	3.0	5.3	4.1
	+	0.6	2.3	3.3	2.3	1.7	1.8	2.1	1.9	2.6	2.9
MEDIAN DIAMETER IN MICRA BY NUMBER				390	163	100	250	200	130	250	180
MEDIAN DIAMETER IN MICRA BY WEIGHT				476	307	160	3506	250	220	320	320

* USDA
+ CWS

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TABLE I

DATA RELATIVE TO MORTALITY OF ANOPHELINE LARVAE, ADULT FLIES, DEPOSITION OF DDT AND MEDIAN DIAMETERS OF PARTICLES BY WEIGHT AND NUMBER

PLANE: L-5
EQUIPMENT: Breaker Bar
DELIVERY RATE: 10 Gal. per Minute
PRESSURE: 120 Lbs PSI

DATE: 14 April 1945
PLANE SPEED: 90 MPH 20% Lube Oil
SPRAY SOLUTION: 5% DDT in 80% No. 2 DFO
STATION POSITION: 40 Ft. Interval

TEST NO. One
TIME: 0823
ALTITUDE: 40 Ft. SE to NW
LINE OF FLIGHT: Between Sta 5-6

LAPSE RATE: T2-T.3-.5
WIND SPEED: 4 MPH
WIND DIRECTION: NNW
WIND DRIFT: Sl. SW

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		100	100	100	100	100	30	5	0	0	5
MINUTES TO KNOCKDOWN OF ADULT FLIES IN PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 50%	7	7	6	7	15					
	Morib. 100%	14	14	14	9	19	180+	180+	180+	180+	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	8.1	3.8	32.5	21.4	4.5	0.0	0.0	0.0	0.0	0.0
	+	7.2	5.6	16.9	9.9	1.3	0.0	0.0	0.0	0.0	0.0
MEDIAN DIAMETER IN MICRA BY NUMBER		55	55	105	165	-					
MEDIAN DIAMETER IN MICRA BY WEIGHT		135	125	210	175	-					

TEST NO. Two
TIME: 0833
ALTITUDE: 40 Ft. SE - NW
LINE OF FLIGHT: Between Sta 8-9

LAPSE RATE: T2-T.3-.6
WIND SPEED: 5 MPH
WIND DIRECTION: NNE
WIND DRIFT: To SW

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		100	75	80	100	90	100	100	10	10	45
MINUTES TO KNOCKDOWN OF ADULT FLIES IN PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 50%	40	15	44	18	15	8	7			
	Morib. 100%	180+	32	110	30	55	16	14	180+	180+	180+
MGM OF DDT RECOVERED PER SQUARE METER	*	0.7	2.5	1.5	1.5	3.7	42.8	69.4	0.0	0.0	0.0
	+	0.2	1.8	1.1	1.4	2.1	8.0	12.8	0.0	0.0	0.0
MEDIAN DIAMETER IN MICRA BY NUMBER		30	60	35	65	55	205	185			
MEDIAN DIAMETER IN MICRA BY WEIGHT		155	155	130	145	155	235	390			

* AML
+ CWS

Inclosure V, Page 1.

TABLE II

DATA RELATIVE TO MORTALITY OF ANOPHELINE LARVAE, ADULT FLIES, DEPOSITION OF DDT AND MEDIAN DIAMETERS OF PARTICLES BY WEIGHT AND NUMBER

PLANE: L-5
EQUIPMENT: Breaker Bar
DELIVERY RATE: 10 Gal. per Minute
PRESSURE: 120 Lbs. PSI
DATE: 14 April 1945
PLANE SPEED: 90 MPH 20% Lube Oil
SPRAY SOLUTION: 5% DDT in 80% No. 2 DFO
STATION POSITION: 40 Ft. Interval

TEST NO. Three
TIME: 0847
ALTITUDE: 100 Ft.
LINE OF FLIGHT: 125 Ft. beyond Sta 10 SE to NW
LAPSE RATE: T2-T.3-1.0
WIND SPEED: 7 MPH
WIND DIRECTION: ENE
WIND DRIFT: To SW

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		10	80	100	100	100	100	100	100	100	100
MINUTES TO KNOCK DOWN OF ADULT FLIES IN PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 50%	179	77	41	24	19	12	12	12	13	12
	Morib. 100%	180+	180+	180+	31	30	20	28	20	28	23
MGM OF DDT RECOVERED PER SQUARE METER	*	0.5	0.4	0.8	1.7	1.7	7.6	12.8	8.9	10.8	13.7
	+	0.3	0.5	0.9	1.4	2.7	6.2	6.1	6.0	4.1	4.5
MEDIAN DIAMETER IN MICRA BY NUMBER		60	35	55	60	65	95	135	70	170	195
MEDIAN DIAMETER IN MICRA BY WEIGHT		105	120	115	115	105	140	175	245	240	420

TEST NO. Four
TIME: 0900
ALTITUDE: 100 Ft.
LINE OF FLIGHT: 125 Ft beyond Sta. 10 SE to NW
LAPSE RATE: T2-T.3-.2
WIND SPEED: 6 MPH
WIND DIRECTION: E
WIND DRIFT: SE

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		5	80	-	40	100	100	100	100	100	90
MINUTES TO KNOCKDOWN OF ADULT FLIES IN PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 50%	41	64			54	23	16	12	13	15
	Morib. 100%	180+	180+	180+	180+	180+	40	28	15	30	33
MGM OF DDT RECOVERED PER SQUARE METER	*	0.3	1.2	0.6	0.2	0.6	1.5	3.5	9.2	2.8	11.4
	+	0.3	0.9	0.6	0.4	1.1	2.0	4.0	6.1	2.9	7.7
MEDIAN DIAMETER IN MICRA BY NUMBER		40	60	30	35	20	50	50	85	95	115
MEDIAN DIAMETER IN MICRA BY WEIGHT		75	115	60	80	110	120	150	170	155	205

* AML
+ CWS

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TABLE III

DATA RELATIVE TO MORTALITY OF ANOPHELINE LARVAE, ADULT FLIES, DEPOSITION OF DDT AND MEDIAN DIAMETERS OF PARTICLES BY WEIGHT AND NUMBER

PLANE: L-5
EQUIPMENT: Breaker Bar
DELIVERY RATE: 10 Gal. per Minute
PRESSURE: 120 Lbs. PSI

DATE: 14 April 1945
PLANE SPEED: 90 MPH
SPRAY SOLUTION: 5% DDT in 80% No. 2 DFO 20% Lube Oil
STATION POSITION: 40 Ft. Interval

TEST NO. Five
TIME: 0925
ALTITUDE: 40 Ft.
LINE OF FLIGHT: Sta. 6 W to ENE (into wind)

LAPSE RATE: T2-T.3-1.4
WIND SPEED: 6 MPH
WIND DIRECTION: ENE
WIND DRIFT: Sl. to S

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		5	100	100	100	100	100	90	70	40	90
MINUTES TO KNOCKDOWN OF ADULT FLIES IN PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 50%	13	13	11	11	8	18	28	33		
	Morib. 100%	22	30	23	25	13	180+	111	180+	180+	-
MGM OF DDT RECOVERED PER SQUARE METER	*	2.8	2.8	8.2	8.4	50.9	1.7	1.7	1.0	0.3	0.8
	♦	2.9	3.2	7.4	5.2	12.8	1.7	1.5	1.1	0.5	0.6
MEDIAN DIAMETER IN MICRA BY NUMBER		65	55	65	90	190	85	65	65	25	40
MEDIAN DIAMETER IN MICRA BY WEIGHT		135	160	160	210	335	115	160	160	145	155

TEST NO. Six
TIME: 0945
ALTITUDE: 40 Ft.
LINE OF FLIGHT: Sta. 6 E to W (Downwind)

LAPSE RATE: T2-T.3-1.1
WIND SPEED: 5 MPH
WIND DIRECTION: E
WIND DRIFT: None

STATION		1	2	3	4	5	6	7	8	9	10
% MORTALITY OF ANOPHELINE LARVAE		30	75	10	45	65	95	100	100	95	100
MINUTES TO KNOCKDOWN OF ADULT FLIES IN PETRI DISHES EXPOSED IN SPRAY AREA	Morib. 50%	124					21	13	9	50	13
	Morib. 100%	180+	180+	180+	180+	180+	59	50	10	180+	38
MGM OF DDT RECOVERED PER SQUARE METER	*	0.5	0.7	0.6	0.4	0.06	2.7	1.0	30.4	1.8	4.5
	♦	0.5	0.3	0.3	0.3	0.4	3.1	7.9	17.7	1.8	3.5
MEDIAN DIAMETER IN MICRA BY NUMBER		55	60	50	120	35	70	50	95	40	45
MEDIAN DIAMETER IN MICRA BY WEIGHT		125	140	115	95	60	140	155	165	100	170

* AML
♦ CWS

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DATA ON PARTICLE SIZE AND DISTRIBUTION

In the evaluation of sprays and spray apparatus, various methods have been employed for the determination of particle size. These include the use of waved slides, single and four stage cascade impactors, jump cards, and magnesium oxide slides. Considerable controversy exists at the present time as to what constitutes the most satisfactory method of determining particle sizes, their distribution throughout the spray swath, the median diameters by weight and number, and the particle size spectra at the various points of investigation. It would appear from experience gained in this and previous work, that satisfactory determinations of the various ranges can only be obtained through modified uses of these methods and their intelligent application to the range of the particle sizes under study. In determinations of spray depositions and percentages of recovery, constant check must be maintained between the CWS colorimetric determination and the arithmetic computations derived from the spray particles recovered in the spectra determinations.

The method of spray collection, which has proven to be most satisfactory for the work carried on at AFTAC has been the magnesium oxide method. In this method squares of glass are coated with magnesium oxide by suspending these pieces of glass in the smoke of a burning magnesium ribbon. The use of these squares of glass has proven to be too awkward for large scale operations, and on this account microscope slides are used marking the station position on the back of the slide with a waxed pencil. A trained worker is able to prepare several hundred slides within a few hours. Care must be taken to anticipate the approximate diameter of the particles for which the slides are being prepared and to place an oxide coating known to be equal in depth or greater than the diameter of the largest particle expected to be encountered. Each spray particle striking the slide is imbedded in the magnesium oxide coating leaving a crater, the outer dimensions of which represent the circumference of the spray particle. The effective range of the slides is fifteen to three hundred micra. Particles greater than three hundred micra may be measured by predetermining the spread factor involved. In such cases, however, less complicated methods suffice for measuring these particles and the use of magnesium oxide slides is not indicated. The main advantage in the use of these slides lies in their permanence. These may be returned to a laboratory and the particles measured at a later time. This enables a small staff of workers to cover adequately large areas during actual control operations. Due to the evaporation of solvents, and other variables, this is not possible with any of the other methods.

Once the diameters of particles and their numbers have been determined, it is necessary to interpret these results in terms of spray efficiency. In order that a sufficiently large sample may be obtained to be statistically significant, it is necessary that sufficient numbers of slides be taken during each particular operation. Dependent

upon the size of the spray swath expected, slides should be placed at the stations across the swath width at frequent intervals. At least ten slides should be exposed for each determination. This number preferably should be increased to twenty or twenty-five, dependent upon the numbers of personnel available for measurements and calculations.

Of prime interest to the observer are the numbers of particles per square inch, the diameter of the largest particle measured, and the median diameters by weight and number. These last represent the point at which fifty percent of the spray particles and the spray volume lies. The median diameter by number is the diameter of that particle below which are fifty percent of the particles. Similarly the median diameter by weight is the diameter of that particle below which is fifty percent of the volume of the spray. When sufficiently large numbers of median diameters by weight and by number have been obtained, these medians may be averaged to achieve an average median diameter by weight and an average median diameter by number. These tend to give a reasonably accurate indication of the spray characteristics of a given spray apparatus. This permits determination of whether such apparatus is more suitable for adult control or larval control or whether the apparatus may function for both phases of control.

In order to determine the action of such factors as meteorological conditions upon the spray swath, spray particle spectra are taken for each of the stations across the spray swath width. In these the percentages of particles by weight and by number are reported below diameters of twenty-five, fifty, seventy-five, one hundred, one hundred fifty, two hundred, two hundred fifty, and three hundred micra. From this may be obtained an accurate estimation of the percentages of particles by weight and by number, existing within the various ranges. The figures are of particular interest when attempting to evaluate the penetration of canopy and dwellings by spray released from various types of apparatus. When these figures are supplemented by biological data taken at the same point, assumptions may be made as to the optimum droplet-size range suitable for larval or adult kill of mosquitoes and flies. From the data obtained in the computation of spray spectra, recovery figures may be obtained showing an excellent corelation with similar data obtained by the CWS colorimetric determinations of DDT recovery.

TABLE II
PARTICLE SIZE AND DISTRIBUTION

A. GENERAL DATA

DATE: 14 April 1945
TEST RUN NO.: Two
PLANE: L-5
DISPENSER: Breaker Bar
WIND: 5 MPH NNE
TIME: 0833

SPRAY: 5% DDT in 80% No. 2 DFO, 20% Lube Oil
PLANE SPEED: 90 MPH
ALTITUDE: 40 Ft.
SWATH WIDTH: 200 Ft.
RATE OF FLOW: 10 Gallons per Minute
FLIGHT: Between Sta. 8-9 SE to NW

B. PARTICLE SIZE, DISTRIBUTION, AND MEDIAN DIAMETERS

STATION NUMBER	1	2	3	4	5	6	7	8	9	10
NUMBER OF PARTICLES PER SQUARE INCH	32	49	53	63	65	126	84	0	0	0
DIAMETER OF LARGEST PARTICLE MEASURED	180	190	155	215	205	290	540	0	0	0
MEDIAN DIAMETER BY NUMBER	30	60	35	65	55	205	185	0	0	0
MEDIAN DIAMETER BY WEIGHT	155	155	130	145	155	235	390	0	0	0

AVERAGE NUMBER OF PARTICLES PER SQUARE INCH: 67 Particles
AVERAGE MEDIAN DIAMETER BY NUMBER: 90 micra
AVERAGE MEDIAN DIAMETER BY WEIGHT: 195 micra

C. PARTICLE SIZE SPECTRUM BY PERCENTAGES BY WEIGHT AND BY NUMBER BELOW GIVEN DIAMETERS

STATION NUMBER		1	2	3	4	5	6	7	8	9	10
PERCENT OF PARTICLES	WT.	0.51	0.12	0.3	0.16	0.13	0.004	0.0	0	0	0
BELOW 25 mu BY	NO.	40.6	18.4	34.0	9.1	26.2	3.2	0.0	0	0	0
PERCENT OF PARTICLES	WT.	5.2	1.7	2.46	1.04	1.3	0.09	0.0	0	0	0
BELOW 50 mu BY	NO.	75.0	44.9	56.6	34.9	49.3	11.2	0.0	0	0	0
PERCENT OF PARTICLES	WT.	11.5	3.4	10.8	5.3	2.7	0.43	0.0	0	0	0
BELOW 75 mu BY	NO.	87.5	53.0	73.6	54.0	57.0	19.8	0.0	0	0	0
PERCENT OR PARTICLES	WT.	22.2	9.7	16.6	15.9	6.8	1.4	0.0	0	0	0
BELOW 100 mu BY	NO.	90.6	63.3	79.2	69.8	64.6	28.6	0.0	0	0	0
PERCENT OF PARTICLES	WT.	40.7	49.3	67.2	53.0	38.0	3.0	2.3	0	0	0
BELOW 150 mu BY	NO.	93.8	87.8	94.4	90.5	84.7	34.2	23.8	0	0	0
PERCENT OF PARTICLES	WT.	100	100	100	85.6	80.7	14.0	9.8	0	0	0
BELOW 200 mu BY	NO.	100	100	100	98.5	97.0	49.2	52.4	0	0	0
PERCENT OF PARTICLES	WT.				100	100	66.6	21.7	0	0	0
BELOW 250 mu BY	NO.				100	100	85.0	72.6	0	0	0
PERCENT OF PARTICLES	WT.						100	30.2	0	0	0
BELOW 300 mu BY	NO.						100	81.0	0	0	0
PERCENT OF PARTICLES	WT.							100	0	0	0
OVER 300 mu BY	NO.							100	0	0	0

Particle size data computed by Magnesium Oxide Method--
Aero-Medical Laboratory, Wright Field, Dayton, Ohio

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TABLE I
PARTICLE SIZE AND DISTRIBUTION

A. GENERAL DATA

DATE: 14 April 1945
TEST RUN NO.: One
PLANE: L-5
DISPENSER: Breaker Bar
WIND: 4 MPH NNW
TIME: 0823

SPRAY: 5% DDT in 80% No. 2 DFO, 20% Lube Oil
PLANE SPEED: 90 MPH
ALTITUDE: 40 Ft.
SWATH WIDTH: 160 Ft.
RATE OF FLOW: 10 Gallons per Minute
FLIGHT: Between Sta. 5-6 SE to NW

B. PARTICLE SIZE, DISTRIBUTION AND MEDIAN DIAMETERS

STATION NUMBER	1	2	3	4	5	6	7	8	9	10
NUMBER OF PARTICLES PER SQUARE INCH	235	165	210	115	3	0	0	0	0	0
DIAMETER OF LARGEST PARTICLE MEASURED	215	190	360	240	330	0	0	0	0	0
MEDIAN DIAMETER BY NUMBER	55	55	105	165		0	0	0	0	0
MEDIAN DIAMETER BY WEIGHT	135	125	210	175		0	0	0	0	0

AVERAGE NUMBER OF PARTICLES PER SQUARE INCH: 146 Particles
AVERAGE MEDIAN DIAMETER BY NUMBER: 95 micra
AVERAGE MEDIAN DIAMETER BY WEIGHT: 160 micra

C. PARTICLE SIZE SPECTRUM BY PERCENTAGES BY WEIGHT AND BY NUMBER BELOW GIVEN DIAMETERS

STATION NUMBER		1	2	3	4	5	6	7	8	9	10
PERCENT OF PARTICLES	WT.	0.2	0.39	0.02	0.0	0.0	0	0	0	0	0
BELOW 25 mu BY	NO.	23.4	21.8	11.4	0.0	0.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.	1.8	3.6	0.32	0.08	0.0	0	0	0	0	0
BELOW 50 mu BY	NO.	42.5	44.8	24.2	4.35	0.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.	9.6	16.5	1.4	0.46	0.0	0	0	0	0	0
BELOW 75 mu BY	NO.	63.0	69.4	38.1	9.6	0.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.	19.5	33.0	3.3	2.0	0.0	0	0	0	0	0
BELOW 100 mu BY	NO.	74.8	82.7	48.1	17.4	0.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.	61.8	79.0	11.9	13.6	0.0	0	0	0	0	0
BELOW 150 mu BY	NO.	93.2	97.6	63.8	40.0	0.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.	94.5	100	39.0	67.0	0.0	0	0	0	0	0
BELOW 200 mu BY	NO.	99.5	100	83.4	87.0	0.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.	100		74.5	100	0.0	0	0	0	0	0
BELOW 250 mu BY	NO.	100		95.6	100	0.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.			90.5		25.3	0	0	0	0	0
BELOW 300 mu BY	NO.			99.0		33.0	0	0	0	0	0
PERCENT OF PARTICLES	WT.			100		100	0	0	0	0	0
OVER 300 mu BY	NO.			100		100	0	0	0	0	0

Particle size data computed by Magnesium Oxide Method—
Aero-Medical Laboratory, Wright Field, Dayton, Ohio

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TABLE III
PARTICLE SIZE AND DISTRIBUTION

A. GENERAL DATA

DATE: 14 April 1945
TEST RUN NO.: Three
PLANE: L-5
DISPENSER: Breaker Bar
WIND: 7 MPH ENE
TIME: 0847

SPRAY: 5% DDT in 80% No. 2 DFO, 20% Lube Oil
PLANE SPEED: 90 MPH
ALTITUDE: 100 Ft.
SWATH WIDTH: 280 Ft.
RATE OF FLOW: 10 Gallons per Minute
FLIGHT: 125 Ft. beyond Sta. 10 SE to NW

B. PARTICLE SIZE, DISTRIBUTION AND MEDIAN DIAMETERS

STATION NUMBER	1	2	3	4	5	6	7	8	9	10
NUMBER OF PARTICLES PER SQUARE INCH	20	16	28	52	64	113	95	73	32	17
DIAMETER OF LARGEST PARTICLE MEASURED	155	180	170	180	240	240	240	335	360	600
MEDIAN DIAMETER BY NUMBER	60	35	55	60	65	95	135	70	170	195
MEDIAN DIAMETER BY WEIGHT	105	120	115	115	105	140	175	245	240	420

AVERAGE NUMBER OF PARTICLES PER SQUARE INCH: 51 Particles
AVERAGE MEDIAN DIAMETER BY NUMBER: 95 micra
AVERAGE MEDIAN DIAMETER BY WEIGHT: 180 micra

C. PARTICLE SIZE SPECTRUM BY PERCENTAGES BY WEIGHT AND BY NUMBER BELOW GIVEN DIAMETERS

STATION NUMBER		1	2	3	4	5	6	7	8	9	10
PERCENT OF PARTICLES	WT.	0.24	0.42	0.32	0.14	0.15	0.11	0.03	0.02	0.0	0.0
BELOW 25 mu BY	NO.	10.0	43.8	21.4	13.5	11.0	21.2	11.6	11.0	0.0	0.0
PERCENT OF PARTICLES	WT.	4.3	3.6	2.8	2.7	2.2	0.56	0.35	0.46	0.04	0.0
BELOW 50 mu BY	NO.	40.0	62.5	46.4	36.5	32.8	26.6	26.3	24.7	6.3	0.0
PERCENT OF PARTICLES	WT.	13.2	16.9	10.6	9.4	13.4	3.1	0.67	3.0	1.1	0.0
BELOW 75 mu BY	NO.	60.8	81.2	67.8	55.7	56.2	40.7	29.5	52.1	15.6	0.0
PERCENT OF PARTICLES	WT.	33.8	30.9	20.1	28.5	37.5	10.3	1.1	6.5	1.1	0.0
BELOW 100 mu BY	NO.	80.0	93.6	78.5	78.1	78.8	55.8	31.6	64.4	15.6	0.0
PERCENT OF PARTICLES	WT.	67.2	30.9	53.3	63.3	88.5	51.3	13.9	20.2	7.5	0.49
BELOW 150 mu BY	NO.	95.0	93.6	92.7	94.2	98.5	89.4	52.7	83.6	40.6	5.9
PERCENT OF PARTICLES	WT.	100	100	100	100	100	73.8	75.5	36.2	32.8	12.0
BELOW 200 mu BY	NO.	100	100	100	100	100	96.5	91.6	93.2	75.0	47.1
PERCENT OF PARTICLES	WT.						100	100	51.3	48.4	38.5
BELOW 250 mu BY	NO.						100	100	96.0	87.5	94.0
PERCENT OF PARTICLES	WT.								66.0	67.1	38.5
BELOW 300 my BY	NO.								97.3	93.8	94.0
PERCENT OF PARTICLES	WT.								100	100	100
OVER 300 mu BY	NO.								100	100	100

Particle size data computed by Magnesium Oxide Method—
Aero-Medical Laboratory, Wright Field, Datyon, Ohio

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TABLE IV
PARTICLE SIZE AND DISTRIBUTION

A. GENERAL DATA

DATE: 14 April 1945
TEST RUN NO.: Four
PLANE: L-5
DISPENSER: Breaker Bar
WIND: 6 MPH E
TIME: 0900

SPRAY: 5% DDT in 80% No. 2 DFO, 20% Lube Oil
PLANE SPEED: 90 MPH
ALTITUDE: 100 Ft.
SWATH WIDTH: 200 Ft.
RATE OF FLOW: 10 Gallons per Minute
FLIGHT: 125 Ft. beyond Sta. 10 SE to NW

B. PARTICLE SIZE, DISTRIBUTION AND MEDIAN DIAMETERS

STATION NUMBER	1	2	3	4	5	6	7	8	9	10
NUMBER OF PARTICLES PER SQUARE INCH	30	42	12	19	42	48	80	100	35	65
DIAMETER OF LARGEST PARTICLE MEASURED	120	170	85	120	145	170	215	225	215	310
MEDIAN DIAMETER BY NUMBER	40	60	30	35	20	50	50	85	95	115
MEDIAN DIAMETER BY WEIGHT	75	115	60	80	110	120	150	170	155	205

AVERAGE NUMBER OF PARTICLES PER SQUARE INCH: 47 Particles
AVERAGE MEDIAN DIAMETER BY NUMBER: 60 micra
AVERAGE MEDIAN DIAMETER BY WEIGHT: 125 micra

C. PARTICLE SIZE SPECTRUM BY PERCENTAGES BY WEIGHT AND BY NUMBER BELOW GIVEN DIAMETERS

STATION NUMBER		1	2	3	4	5	6	7	8	9	10
PERCENT OF PARTICLES	WT.	0.58	0.28	2.1	0.58	1.0	0.22	0.21	0.09	0.05	0.01
BELOW 25 mu BY	NO.	23.3	23.8	25.0	36.9	52.4	25.0	27.5	18.0	14.3	3.1
PERCENT OF PARTICLES	WT.	15.7	2.1	30.3	10.8	4.5	2.4	2.2	0.57	0.45	0.09
BELOW 50 mu BY	NO.	63.4	42.8	83.2	63.2	66.6	45.8	50.0	30.0	31.4	7.7
PERCENT OF PARTICLES	WT.	48.6	9.4	57.2	44.3	21.0	7.6	5.6	2.1	1.6	1.0
BELOW 75 mu BY	NO.	90.0	57.1	91.6	89.5	83.4	62.5	63.8	42.0	40.0	20.0
PERCENT OF PARTICLES	WT.	72.4	35.4	100	58.5	36.8	15.6	14.5	7.8	5.4	2.6
BELOW 100 mu BY	NO.	96.6	80.9	100	94.8	90.6	70.9	76.3	59.0	48.6	29.2
PERCENT OF PARTICLES	WT.	100	83.3		100	100	76.6	45.2	34.7	37.3	15.1
BELOW 150 mu BY	NO.	100	97.6		100	100	96.0	91.4	86.0	80.0	60.0
PERCENT OF PARTICLES	WT.		100				100	86.7	61.0	84.2	47.2
BELOW 200 mu BY	NO.		100				100	98.8	97.0	97.1	83.0
PERCENT OF PARTICLES	WT.							100	70.5	100	88.5
BELOW 250 mu BY	NO.							100	98.0	100	98.5
PERCENT OF PARTICLES	WT.								70.5		88.5
BELOW 300 mu BY	NO.								98.0		98.5
PERCENT OF PARTICLES	WT.								100		100
OVER 300 mu BY	NO.								100		100

Particle size data computed by Magnesium Oxide Method--
Aero-Medical Laboratory, Wright Field, Dayton, Ohio

TABLE V
PARTICLE SIZE AND DISTRIBUTION

A. GENERAL DATA

DATE: 14 April 1945
TEST RUN NO.: Five
PLANE: L-5
DISPENSER: Breaker Bar
WIND: 6 MPH ENE
TIME: 0925

SPRAY: 5% DDT in 80% No. 2 DFO, 20% Lube Oil
PLANE SPEED: 90 MPH
ALTITUDE: 40 Ft.
SWATH WIDTH: 200 Ft.
RATE OF FLOW: 10 Gallons per Minute
FLIGHT: Sta. 6, W to ENE (into wind)

B. PARTICLE SIZE, DISTRIBUTION AND MEDIAN DIAMETERS

STATION NUMBER	1	2	3	4	5	6	7	8	9	10
NUMBER OF PARTICLES PER SQUARE INCH	60	97	140	89	38	34	20	18	4	12
DIAMETER OF LARGEST PARTICLE MEASURED	160	190	240	300	275	180	190	190	180	230
MEDIAN DIAMETER BY NUMBER	65	55	65	90	190	85	65	65	25	40
MEDIAN DIAMETER BY WEIGHT	135	160	160	210	335	115	160	160	145	155

AVERAGE NUMBER OF PARTICLES PER SQUARE INCH: 51 Particles
AVERAGE MEDIAN DIAMETER BY NUMBER: 75 micra
AVERAGE MEDIAN DIAMETER BY WEIGHT: 170 micra

C. PARTICLE SIZE SPECTRUM BY PERCENTAGES BY WEIGHT AND BY NUMBER BELOW GIVEN DIAMETERS

STATION NUMBER		1	2	3	4	5	6	7	8	9	10
PERCENT OF PARTICLES	WT.	0.15	0.25	0.18	0.07	0.001	0.05	0.008	0.13	0.04	0.15
BELOW 25 mu BY	NO.	13.3	20.6	27.2	15.7	3.2	14.7	10.0	16.7	50.0	25.0
PERCENT OF PARTICLES	WT.	1.4	2.3	0.95	0.76	0.03	0.17	5.2	0.83	22.9	1.8
BELOW 50 mu BY	NO.	31.7	42.3	42.2	34.8	11.1	17.7	45.0	27.8	75.0	58.4
PERCENT OF PARTICLES	WT.	6.5	14.7	3.0	2.2	0.11	2.2	5.2	8.7	22.9	3.8
BELOW 75 mu BY	NO.	53.3	71.1	52.2	47.2	17.5	26.8	45.0	61.2	75.0	66.7
PERCENT OF PARTICLES	WT.	20.3	28.1	10.7	6.9	0.35	22.6	8.7	14.0	22.9	40.2
BELOW 100 mu BY	NO.	75.0	84.5	67.2	60.7	23.8	61.7	55.0	72.3	75.0	91.8
PERCENT OF PARTICLES	WT.	45.0	61.2	37.6	28.4	2.6	71.4	34.5	34.8	22.9	40.2
BELOW 150 mu BY	NO.	93.2	96.0	87.8	84.4	46.0	94.0	75.0	83.4	75.0	91.8
PERCENT OF PARTICLES	WT.	100	100	62.2	44.8	3.3	100	100	100	100	40.2
BELOW 200 mu BY	NO.	100	100	95.0	92.1	49.2	100	100	100	100	91.8
PERCENT OF PARTICLES	WT.			100	60.0	7.2					100
BELOW 250 mu BY	NO.			100	95.5	55.5					100
PERCENT OF PARTICLES	WT.				100	28.8					
BELOW 300 mu BY	NO.				100	73.0					
PERCENT OF PARTICLES	WT.					100					
OVER 300 mu BY	NO.					100					

Particle size data computed by Magnesium Oxide Method—
Aero-Medical Laboratory, Wright Field, Dayton, Ohio

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TABLE VI
PARTICLE SIZE AND DISTRIBUTION

A. GENERAL DATA

DATE: 14 April 1945
TEST RUN NO.: Six
PLANE: L-5
DISPENSER: Breaker Bar
WIND: 5 MPH E
TIME: 0945

SPRAY: 5% DDT in 80% No. 2 DFO, 20% Lube Oil
PLANE SPEED: 90 MPH
ALTITUDE: 40 Ft.
SWATH WIDTH: 160 Ft.
RATE OF FLOW: 10 Gallons per Minute
FLIGHT: Sta. 6, E to W (downwind)

B. PARTICLE SIZE, DISTRIBUTION AND MEDIAN DIAMETERS

STATION NUMBER	1	2	3	4	5	6	7	8	9	10
NUMBER OF PARTICLES PER SQUARE INCH	12	16	21	18	7	56	239	351	112	99
DIAMETER OF LARGEST PARTICLE MEASURED	180	170	180	75	85	240	325	395	170	350
MEDIAN DIAMETER BY NUMBER	55	60	50	120	35	70	50	95	40	45
MEDIAN DIAMETER BY WEIGHT	125	140	115	95	60	140	155	165	100	170

AVERAGE NUMBER OF PARTICLES PER SQUARE INCH: 63 Particles
AVERAGE MEDIAN DIAMETER BY NUMBER: 60 micra
AVERAGE MEDIAN DIAMETER BY WEIGHT: 130 micra

C. PARTICLE SIZE SPECTRUM BY PERCENTAGES BY WEIGHT AND BY NUMBER BELOW GIVEN DIAMETERS

STATION NUMBER		1	2	3	4	5	6	7	8	9	10
PERCENT OF PARTICLES	WT.	0.14	0.03	0.22	0.15	1.1	0.08	0.2	0.04	0.62	0.14
BELOW 25 mu BY	NO.	16.6	18.8	19.0	11.1	42.9	12.5	23.9	8.8	28.6	24.3
PERCENT OF PARTICLES	WT.	2.6	1.6	2.7	0.84	8.4	1.4	1.9	0.42	5.6	2.0
BELOW 50 mu BY	NO.	41.6	37.5	42.8	27.8	57.2	30.3	49.0	21.1	55.4	51.4
PERCENT OF PARTICLES	WT.	6.5	4.1	9.9	8.8	22.5	7.5	5.9	2.9	17.7	6.9
BELOW 75 mu BY	NO.	58.3	50.0	61.9	44.4	71.5	53.5	62.7	39.0	73.2	69.8
PERCENT OF PARTICLES	WT.	19.8	22.9	34.6	52.5	100	21.2	16.1	7.3	42.8	9.6
BELOW 100 mu BY	NO.	75.0	75.0	85.8	83.1	100	75.0	77.4	51.3	87.5	79.9
PERCENT OF PARTICLES	WT.	47.2	50.5	59.3	100		55.8	37.8	37.6	89.6	34.4
BELOW 150 mu BY	NO.	91.6	87.5	95.2	100		92.8	89.1	83.5	99.0	95.0
PERCENT OF PARTICLES	WT.	100	100	100			78.7	85.5	62.5	100	37.7
BELOW 200 mu BY	NO.	100	100	100			98.1	98.8	94.8	100	96.0
PERCENT OF PARTICLES	WT.						100	86.3	85.0		60.6
BELOW 250 mu BY	NO.						100	99.5	99.2		99.0
PERCENT OF PARTICLES	WT.							86.3	89.7		60.6
BELOW 300 mu BY	NO.							99.5	99.6		99.0
PERCENT OF PARTICLES	WT.							100	100		100
OVER 300 mu BY	NO.							100	100		100

Particle size data computed by Magnesium Oxide Method—
Aero-Medical Laboratory, Wright Field, Dayton, Ohio

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Fig. 1 L-5 in operation with breaker-bar type spray equipment.

Fig. 2 Side-oblique view of L-5 operating with breaker-bar spray equipment.

Fig. 3 L-5 equipped with jet type dispenser (compare with swath width of breaker-bar equipment shown in Figs. 1 and 2).

Fig. 4 L-4 jet type spray equipment (Spec. No. T-2281: Sprayer, Insect, Airplane, Corps of Engineers) adapted to L-5 by removal of venturi (shown in operation in Fig. 3).

Fig. 5 Closeup of rear of wind-driven herringbone pump: end of breaker-bar shown at lower left.

Fig. 6 Front oblique view of pump and breaker-bar installation.

Fig. 7 Side view of spray installation showing position of breaker bar in relation to orifice area along rear surface of spray pipe.

Fig. 8 Observer checking field station (items at each station include (1) anopheline larvae in pint containers; (2) petri dishes for subsequent biological testing following exposure; and (3) CWS porcelain plates).

Fig. 9 Observers collecting exposed CWS porcelain plates, larval containers and petri dishes.

Fig. 10 Weather station established at test area for obtaining meterological data.

Inclosure 3
Air Technical Service Command Memorandum Report
Dated 9 April 1945

ARMY AIR FORCES
ENGINEERING DIVISION
AIR TECHNICAL SERVICE COMMAND
MEMORANDUM REPORT ON

TSEPL3H6
Capt. L.A. Otterson/vb
Extension 2-4179

9 April 1945

SUBJECT: DDT Spray Equipment for Liaison Type Aircraft (L-5)

OFFICE : Equipment Laboratory Contract Order No.

SERIAL NO: TSEPL3H-664-647 Expenditure Order No. 664-647

A. Purpose: To report on a trip to the Army Air Forces Board on 30 March to 1 April 1945 to coordinate DDT Spray Equipment for liaison type aircraft under development jointly by this Command and by the Bureau of Entomology and Plant Quarantine through the Army Air Forces Board.

B. Factual Data:

1. Personnel present were:

Colonel Schreuder	-	AAF Tactical Center
Lt. Col. Daniels	-	AAF Tactical Center
Captain Sullivan	-	AAF Tactical Center
Lt. Col. Cummings	-	AAF Board
Mr. Knipping	-	Bureau of Entomology and Plant Quarantine
Capt. L. A. Otterson	-	Air Technical Service Command

2. Equipment as developed by the Bureau of Entomology and Plant Quarantine for L-5 Airplane was examined and consists of primarily the following: DDT solution tank of approximately 40 gallons in the rear seat of the airplane with a hose connecting to a wind driven pump mounted on the wing struts, supplying insecticide to spray attachments mounted out on the wing struts beyond a point where no spray would blow back on the tail surfaces. This equipment is primarily the same as was procured for the L-4 type aircraft and described in Corps of Engineers specification T-2281 titled: "Spray, Insect, Airplane".

3. The requirements as set forth by Assistant Chief of Air Staff, Operations, Commitments and Requirements and forwarded to this Command by directive from Assistant Chief of Air Staff, Materiel and Services dated 15 February 1945, Subject: "Airborne Insect Spray System (Light)", describing compact lightweight quickly and easily detachable and

demountable spray unit with a gross weight not over 200 pounds, to be in multiple units if advisable, that is, one unit on each wing capable of dispensing maximum spray consistent with the weight limitation on the airplane (provisions have been incorporated for shackles on liaison type aircraft), capable of spray operation at least equivalent to the equipment now being procured on the Corps of Engineers specification.

4. The equipment is now being developed by the Bureau of Entomology and Plant Quarantine appears to be very satisfactory for the purpose of insect spraying operations. This equipment is in the test stage and definite information as to suitability should be available in the near future. The Bureau of Entomology and Plant Quarantine has requested that the ATSC coordinate engineering approval on this equipment.

C. Conclusions:

1. In reviewing the requirements established by the Assistant Chief of Air Staff, Operations, Commitments and Requirements, it is concluded that they are not met by the equipment under development by the Bureau of Entomology and Plant Quarantine.

2. The equipment under development by the Bureau of Entomology and Plant Quarantine appears to be a satisfactory solution to the insect spray problem for the near future.

D. Recommendations:

1. It is recommended that the following action be taken by the organizations listed below:

a. Engineering Division, Air Technical Service Command

(1) Continue project to develop equipment as directed by the Office of Assistant Chief of Air Staff, Materiel and Services. (Action Initiated)

b. Army Air Forces Board, Orlando, Florida

(1) Set up a special project to evaluate the equipment as developed by the Bureau of Entomology and Plant Quarantine as an immediate answer to the problem of spraying insecticide from liaison type aircraft.

Equipment Laboratory, Engineering Division
Memorandum Report No. TSEPL3H-664-647
9 April 1945

Prepared by: /s/ L. A. Otterson
L. A. OTTERSON, Captain, Air Corps
(Name)

Approved by: /s/ S. R. Stewart
S. R. STEWART, Colonel, Air Corps
Chief, Equipment Laboratory
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DEVELOPMENT AND TEST OF SPRAY EQUIPMENT FOR L-5 AIRCRAFT FOR DISSEMINATION OF INSECTICIDE DDT

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